Policy, Planning, and Research

WORKING PAPERS

Public Economics

Country Economics Department
The World Bank
September 1989
WPS 278

Inflation and the Company Tax Base

Methods to Minimize Inflation-induced Distortions

Anand Rajaram

Conceptually, the most accurate way to correct for inflation in reporting taxable income is to index the balance sheet and derive income as a residual. The experience of Argentina, Brazil, and Chile indicates that this method is workable. Whether it is practical for other countries depends on the administrative and bookkeeping limitations of each case.

Policy, Planning, and Research

WORKING PAPERS

Public Economics

Inflation causes conventionally reported income to differ from real economic income because standard accounting procedures are based on the assumption of price stability. For example, depreciation deductions based on the historic cost of assets cause a firm's reported income to exceed real economic income. Allowing firms to deduct nominal interest expense has the opposite effect. The valuation of inventory items, capital gain, and foreign exchange gain is similarly distorted.

Because of this mismeasurement of economic income, a tax on reported income may distort economic decisions and generate undesirable distributional effects. Marginal effective tax rates, for example, may differ across sectors, industries, and even firms — making resource allocation less efficient.

The paper discusses three alternatives for avoiding these effects:

1 Indexing items in the income statement.

2 Indexing the balance sheet and deriving the income as a residual.

3 Redefining the tax base in terms of cash flow rather than income.

The option of partial indexation (indexation of a few selected items on the income statement) is shown, through simulations, to be an incomplete and often more distorting "correction" for inflation.

The paper shows, with the help of numerical examples, that the most accurate method to correct for inflation-induced mismeasurement of income is to use alternative 2 — to index the balance sheet and derive the income as a residual. Experience with this approach in Argentina, Brazil, and Chile — three countries that have had high rates of inflation — indicates that the method is administratively practical.

But because this method of inflation adjustment is fairly demanding in terms of the general level of bookkeeping and accounting skills in the economy, its use or recommendation for any country should be guided by a realistic appraisal of those skills. It should be noted that countries like Chile, which employ such comprehensive methods today, arrived at that point after various simpler schemes were gradually modified over several years.

This paper is a product of the Public Economics Division, Country Economics Department. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Ann Bhalla, room N10-059, extension 60359 (70 pages with charts and tables).

CONTENTS

I am indebted to Jesus Seade for suggesting the topic of this paper and for comments and criticism which helped structure the paper. Detailed comments from Charles McLure and Zmarak Shalizi on drafts of this paper helped improve the exposition considerably. I owe thanks to Chad Leechor, Pradeep Mitra, Javad Khalilzadeh-Shirazi, and Wayne Thirsk for discussions and comments.

INFLATION AND THE COMPANY TAX BASE

I. INTRODUCTION

1. Issues

Inflation creates a problem for the measurement of income which translates into a problem of measurement of tax liabilities for any income-based tax. The conventional company income tax base is defined with the implicit assumption of price stability. When this assumption is matched by reality, this base provides an appropriate measure[1] of the taxable income of the firm. Correspondingly, the balance sheet of the firm provides an accurate picture of its net worth. Under inflation, however, the tax base is subject to influences which distort the measurement of economic income and the actions of economic agents. This distortion occurs even when the rate of inflation is perfectly anticipated and firms and individuals enter into contracts which incorporate this expected inflation. When inflation is imperfectly anticipated, firms experience windfall gains or losses and the tax system may amplify these distributional effects in ways which are unintended and undesirable.

In this paper we focus on the effects of perfectly anticipated inflation (i.e expected = actual rate) on a conventional company tax base and consider various approaches to render the base inflation-neutral. Neutrality is understood to imply that the real tax base, measured under inflation, is equivalent to the situation under zero inflation. It is important to understand why the conventional tax base is not

---

1/ We assume here that other issues regarding the definition of income have been resolved. In the following discussion depreciation is assumed to refer to economic rates of depreciation.

inflation-neutral in this sense. The taxable profit of a firm is typically given by the difference between sales revenue and total costs. While some of these values are measured in current prices, others, such as depreciation, are based on historic cost. When the price level is stable the two are equivalent and the measured before-tax profit reflects economic income. When inflation (or deflation) drives a wedge between current prices and the historic values which enter the calculation, the taxable profit figure may understate or overstate economic income.

Typically, inflation is perceived to erode the real value of nominally fixed deductions, leading to an increase in the tax burden on a company. For example, depreciation deductions based on the historic cost of the asset decline in real value with inflation, increasing the taxable income of the firm. The taxation of nominal capital gain and book profit on inventory is also inappropriate and leads to an overstatement of taxable income.

While the above effects suggest the need for adjustment of the value of a firm's assets - depreciable assets such as equipment and plant and depletable assets such as inventory - the need for adjustment of the liability side of the firm's balance sheet is less widely understood. This adjustment recognizes the accrued income to the firm derived from the inflation-induced decline in the real value of its debt. Firms that are allowed to deduct nominal interest expense are overcompensated by the tax system so long as the corresponding decline in real value of debt is not included in taxable income. This increases the distortion towards debt finance under most tax systems which disallow dividend deduction but permit interest deduction.

These various effects are sometimes imperfectly recognized by policy makers, particularly at moderate rates of inflation, and the response of tax authorities to the problem is partial and ad hoc. The experience of high inflation countries in Latin America indicates that corrective measures usually begin with indexation of depreciation deductions, followed by some form of correction of inventory, and an approximate adjustment of capital gains. In rare instances, the adjustment may encompass indexing of interest payments. The adjustments themselves may be crude approximations. Countries which now have comprehensive indexation systems, such as Chile, usually arrived at that point after various partial schemes were modified over a number of years of sustained inflation.

The failure to index the tax base and to correctly adjust for such inflationary anomalies leads to distortion of various economic decisions. Under some circumstances, it depresses the incentive to invest by increasing the marginal effective tax rate (METR) on investment. It introduces a wedge between the METR on debt-financed and equity-financed investment, thus distorting the financing decision in favor of debt. In particular, it discourages investment in long lived assets (for which the erosion of depreciation deductions is more severe), encourages the deferral of income from asset appreciation (which would be taxed on a nominal basis even if there was no real appreciation), and encourages complex transactions designed to either escape or capitalize on the effects of inflation. Horizontal equity becomes problematic since two firms with similar economic income but different structure of assets and liabilities will be treated differently from the tax perspective. The company tax base needs to be adjusted for inflation to be neutral with regard to incentives, the overall tax burden, and the structure of corporate finance. The

distortions are greater, the higher the rate of inflation so that the need to build some adjustment mechanism into the tax system is correspondingly more urgent for economies with high rates of inflation.

ii. Approaches to Inflation Adjustment

Two approaches may be taken to insulate the company tax from the effects of inflation. Both approaches recommend indexation of historical values to estimate the company's real, as opposed to nominal, income. However, such indexation can be more or less comprehensive and it is this which distinguishes the two methods.

The comprehensive balance sheet method begins by adjusting the balance sheet of the firm and derives the income statement and a measure of the inflation-adjusted taxable profit as a residual. The advantage of this approach is that it allows simultaneous adjustment of income flows, undepreciated asset values, and net worth. Thus the bases for income, capital gain, and net wealth taxes are simultaneously corrected for the effects of inflation.

The second method directly adjusts items in the income statement, such as interest and depreciation, for inflation. Inventory valuation may be on a LIFO basis which ensures that holding gains are not taxed. Unlike the balance sheet approach, however, in this case net worth has to be separately adjusted and the calculation of capital gain on sales of assets must take into account the indexed undepreciated basis.

In contrast to these indexation methods, it is sometimes recommended that redefinition of the tax base in terms of <u>cash flow</u> would eliminate the need for inflation adjustments. The cash flow tax base is largely immune to inflationary distortions because it deals only with current dollar values. By allowing full and immediate deduction of capital

asset expenditures and purchase of materials, it sidesteps the need to adjust these items for changes in the price level.

The plan of the paper is as follows: Section II of this paper contains a detailed discussion of the indexing alternatives; direct adjustments to the income statement, and more comprehensive adjustments involving both the balance sheet and the income statement. A series of numerical examples illustrate the methods and effects of adjustment. Section III offers a brief discussion of the cash flow approach in the context of inflation and Section IV summarizes the conclusions of the paper.

II. THE INDEXATION APPROACH

Inflation distorts the measure of income flows and of balance sheet items including net worth. The adjustment of corporate income to take account of changes in the price level can be done by (i) adjusting the income statement items directly and deriving the firm's profit thereby, or by (ii) revaluing the balance sheet and deriving the income statement and taxable profit as a residual. While the first method is more commonly applied, balance sheet adjustment offers a more comprehensive and consistent correction because it takes account of the effect of inflation on assets and liabilities, both real and financial.

In most of the numerical examples used in this paper to illustrate the effects of unindexed and appropriately indexed systems we will assume the following features. Domestic inflation is given by $\pi = 0.20$ while world inflation is given by $\pi_w = 0$. To allow us to focus on the effect of price level changes and abstract from relative price changes we will assume that this is pure inflation i.e. all nominal values increase at a 20 percent rate.

The flat rate tax on corporate profit is given by $\tau = 0.5$ and depreciation deductions, unless otherwise indicated, are on a straight line basis. The real interest rate is $r = 0.05$ and the nominal interest rate is given by $i = 0.26$ $(= \pi + r.(1+\pi))$. The tax system allows deduction of nominal interest expenses. Wherever possible, examples will include for purpose of comparison, a case under zero inflation and one case each of indexed and unindexed estimates of the tax base under inflation.

1. Income Statement Adjustment

Five items, in particular, must be given special attention with regard to appropriate measurement under inflation. These are depreciation allowances, interest expenses, inventory valuation, capital gains/losses and exchange gains/losses. This section considers the full indexation of the items on the income statement where the appropriate form of indexation is discussed for each of the above items. In later sections we consider balance sheet adjustments and the implications of various partial and approximate indexation measures.

Under a tax regime where a flat rate tax is imposed on corporate income and depreciation allowances and interest deductions are allowed, neutrality requires that depreciation allowances be adjusted for inflation and not be based on historic cost. As far as interest deductions are concerned, only real interest expenses should be deductible and consequently the nominal interest rate has to be adjusted for the inflation rate. Since the nominal interest rate under inflation includes a component to compensate the lender for the anticipated decline in the real value of principal, an equivalent way to treat interest expenses is to allow nominal interest deduction but include the decline in real value of debt in taxable income of the borrower. In addition, the cost of goods sold out of inventory, capital gains, and losses on foreign exchange debts need to be adjusted for inflation. The principles underlying such adjustment are discussed under the appropriate headings below.

(a). Depreciation Deduction: All depreciation deduction schemes are attempts to approximate the unrealized change in the market value of a firm's assets. This section illustrates how the nominal value of depreciation deductions may be adjusted so that the real value is

maintained in the face of inflation in the price level. In the illustration below we assume that the asset costs \$1000 (A_0 = 1000) at the time of purchase.

1. Method 1: In the case where a straight line deduction scheme is employed, the simple device of indexing the original cost of the asset to the price level (i.e A_0 $(1+\pi)$) and applying the constant percentage deduction (δ = 0.20) to this annually revalued cost will ensure that inflation does not reduce the real value of depreciation allowances. For the purpose of calculating taxable profit this correction will suffice.

2. Method 2: Table 1(a) below describes a more useful adjustment that indexes the undepreciated basis (col(1)) and derives the corresponding depreciation allowance (D_t in col(2)).

TABLE 1 (a): INDEXING THE UNDEPRECIATED BASIS OF THE ASSET

YEAR	(1) INDEXED BASIS $A_t = R_{t-1}(1+\pi)$	(2) DEPRECIATION $D_t = A_t / T-(t-1)$	(3) REMAINING VALUE $R_t = A_t - D_t$
1	1000	200	800
2	960	240	720
3	864	288	576
4	691.2	345.6	345.6
5	414.72	414.72	-

Assumptions: Original asset cost A_0 = 1000, Life of asset T = 5.

The advantage of this approach is that it reports the indexed undepreciated asset value (R_t) which allows accurate assessment of the real capital gain from sale of capital assets, if and when this were to occur. It also allows the measure of net worth to be adjusted for inflation.

3. **The Effect of Historic-Cost Depreciation:** In the following table (1(b)) we use an income statement to illustrate how historic-cost depreciation causes overstatement of taxable profit. For the sake of isolating this effect we assume that the asset is financed by equity, and that no inventory exists so that purchases account for the cost of goods sold. The cost of other items is assumed to be adjusted by the rate of inflation (π=0.20); thus wage and input costs rise at a 20 percent rate. The example also assumes that the income statement refers to the second year in the life of the asset. Column 1 refers to a no-inflation case while col.2 and 3 refer to 20 percent inflation without and with indexation of depreciation, respectively.

TABLE 1 (b): INFLATION, DEPRECIATION DEDUCTIONS AND TAXABLE PROFIT

Item	π = 0	π = 0.20	
		Unindexed	Indexed
1. Sales Revenue	1000	1200	1200
2. Labor cost	500	600	600
3. Materials	100	120	120
4. Interest	0	0	0
5. Cash costs (2+3+4)	600	720	720
6. Depreciation	200	200	240
7. Total costs (5+6)	800	920	960
8. Taxable profit (1-7)	200	280	240

The numbers above clearly demonstrate that without indexation of the depreciation deduction the taxable profit of the firm is overstated and the real after tax economic income of the firm declines. At π = 0, the taxable

profit of the firm is $200 whereas with $\pi = 0.20$ and unindexed depreciation deduction the taxable profit reported is $280. Clearly, part of what is being subject to tax here is capital and not income. This effect will be more dramatic at higher rates of inflation, the greater the value of depreciable assets, and the longer the period over which the asset is depreciated. Indexing the depreciation leads to taxable profit being exactly 20 percent more in nominal terms than the zero inflation case. The real value of taxable profit is then unaffected by inflation.

4. **The Auerbach-Jorgenson method:** An alternative to indexing depreciation allowances is the Auerbach-Jorgenson (1980) proposal that would permit firms to make a one-time deduction at the time the asset is purchased, equal to the present value of economic depreciation. This method would be equivalent to allowing annual depreciation deductions over the life of the asset under conditions of price stability. Auerbach and Jorgenson envisaged a schedule describing the present value of one dollar's worth of investments for each asset class. Firms would apply the appropriate first year deduction to each purchase of a depreciable asset. This depreciation scheme is similar in some respects to the full-expensing or "cash-flow" treatment of asset purchase.[2] The advantage of the present value deduction is that it eliminates the need to index depreciation since, after the one-time deduction, there are no annual deductions to be eroded by inflation.

2/ The cash-flow treatment of depreciation is discussed below in section III.

(b). Interest Expenses: Consider a firm borrowing $1000 at a real interest rate r = 5 percent. In general, loan contracts will be designed taking into account the expected rate of inflation. The contract will define a nominal interest rate using $i = \pi + r(1+\pi)$ so that when r = 0.05, and π=0.20, then i=0.26. To focus attention on the effect of inflation on interest expense and taxable income, we assume that the firm holds a non-depreciating asset.

TABLE 2: INTEREST DEDUCTION AND INFLATION

Item	(1) Zero inflation $\pi = 0$	$\pi = 0.20$	
		Unindexed	(3) Indexed
1. Sales Revenue	1000	1200	1200
2. Labor cost	500	600	600
3. Materials	100	120	120
4. Interest (on $1000)	50	260	60
5. Cash costs (2+3+4)	650	980	780
6. Depreciation	0	0	0
7. Total costs (5+6)	650	980	780
8. Taxable profit (1-7)	350	220	420

Notice that with zero inflation (col.(1)), the firm's taxable profit is $350. Column (3) describes the calculation of taxable profit under π=0.2 when only <u>real interest expenses</u> are deductible i.e. $r(1+\pi)$ on a principal of $ 1000 = $60. The profit calculation, in this case, meets the test of inflation-neutrality since it ($420) is exactly 20 percent greater than the corresponding number ($350) in the zero inflation case. Column (2) describes the effect of allowing <u>nominal interest deductions</u>- taxable profit is underestimated by $200.

Since the reason for this underestimation is not obvious from the table the following explanation may be illuminating. Attempts by lenders to protect themselves from the effect of inflation may take the form of indexing of the interest rate or of indexing of the principal. The lender wishing to ensure a real rate of return of 5 percent while at the same time protecting the real value of the principal could either adjust the base on which the interest is calculated (base adjustment) or adjust the interest rate which applies to the base (rate adjustment). Under base adjustment the principal amount is indexed to the inflation rate and is increased every period by the rate of inflation (20 % by assumption). If a real interest rate of 5 percent is the contracted rate, the borrower must pay 5 percent on the indexed base amount of $1200 (or equivalently, 6 percent on the original principal $1000). Alternatively, under rate adjustment, the contract may define the nominal interest rate, i, using: $i = \pi + r(1+\pi)$.

These two ways of writing loan contracts are equivalent in that both assure the lender of a real return of 5 percent. The equivalence hinges on the idea that under inflation part of the nominal interest payment merely compensates the lender for the decline in the real value of the debt while the other part is the real service on the debt. This is evident from the expression: $i = \pi + r.(1+\pi)$. Multiply this expression by the loan amount ($1000) and substitute the values of i, r and π from our example (0.26, 0.05 and 0.20, respectively) to give us:

$$260 = 200 + 60$$

which indicates that in our example the nominal interest payment of $260 consists of $200 to maintain the real value of the debt and a real interest payment of $60. Allowing the firm to deduct $260 as interest expense

implies that the $200 decline in the real value of the debt must be included as taxable income. It is precisely because this is not done in column (2) in table 2 that the borrowing firm gains from nominal interest deductibility. Taxable income is underestimated by $200 which is the amount of loss in real value of the $1000 principal at $\pi = 0.20$. The extent to which nominal interest deduction benefits the firm is related in a positive way to the rate of inflation, the amount of indebtedness, and the tax rate. Clearly, lenders are treated in an opposite fashion since nominal interest receipts are taxed while no allowance is made for the decline in the value of the principal.

In many countries firms are allowed to deduct the nominal interest expense (and correspondingly nominal interest income is taxed) but the decline in the real value of the debt is not calculated and included as taxable income. Without this adjustment the firm is overcompensated during inflation and this distortion favours debt financing of investment. The appropriate correction is to either i) allow only real interest deduction or ii) allow nominal interest deduction but include the decline in value of debt in taxable income. This is a convenient exploitation of the equivalence of interest indexing and base indexing indicated in the above example.

In summary, the two options for the tax treatment of interest are:

i) Option One - allow only the real interest payment $r.(1+\pi).L$ to be deducted from income in calculating taxable income.

ii) Option Two - allow firms to deduct the nominal interest payment, $i.L$, from income but include in gross income the value of the decline in real value of the principal $\pi.L$.

The two methods are equivalent in terms of the net tax deduction allowed to the firm but it is often administratively more convenient to employ Option Two which makes the tax base adjustment by estimating the net liabilities of the firm and the decline in its value due to a change in the price level. Both methods provide the necessary inflation indexing of interest payments for tax purposes and avoid the bias towards debt finance due to unqualified nominal interest deductibility.

A number of countries either use or have considered using an approximate correction which disallows a certain fraction of interest expense/income to be deducted/taxed. This disallowed fraction approximates the inflationary component in interest income/expense. Thus the U.S. Treasury in 1984 considered defining an exclusion fraction equal to the ratio of the inflation rate to the nominal rate of interest. Mexico recently introduced an additional deduction which sought to take crude account of the effect of inflation on both depreciation deductions and net indebtedness.[3]

3/ See Francisco Gil Diaz (1987) p.339-341.

(c). Inventory Valuation: As in the case of depreciable assets, inflation creates the problem of valuing materials used in production that may have been purchased before changes in the price level. The increase in price levels may create apparent holding gains for firms which are not part of operational profits since firms typically have to reinvest such profits to maintain physical inventory and taxing such book profits adds to the corporate tax burden. An adjusted measure of the goods sold from inventory is required to avoid the tax on inventory profits generated under inflation.

In order to accurately measure operating income it is necessary to accurately measure cost including the cost of goods sold out of inventory. A general principle is that the cost of goods available for sale (CGAS) minus the value of ending inventory (EI) equals cost of goods sold (CGS).

$$CGS = CGAS - EI$$

Two standard inventory accounting practices, FIFO (first in-first out) and LIFO (last in-first out), yield different estimates of CGS because of the different assumptions involved in EI valuation. Indexed variants of these two methods, I-FIFO and I-LIFO, represent two other inventory accounting methods. These are reviewed in turn.

A. FIFO assumes that the ending inventory consists of the most recently acquired stocks. FIFO's assumption therefore closely matches the physical flow of goods. However, in an inflationary period, it matches low cost inventory against high priced output. Thus it yields a higher EI and a correspondingly smaller CGS under inflation. Profits therefore appear to be larger because inventory profit is included in the firm's income.

B. LIFO assumes that ending inventory consists of the oldest stocks. In an inflationary period, this yields a higher figure for CGS and thus a smaller

estimate of profit. LIFO approximates the replacement cost method and attempts to match current cost with current revenue so long as ending inventory is larger than beginning inventory. LIFO generally does a better job of estimating CGS than FIFO under inflation. The disadvantage of LIFO is that, because it values inventory at oldest incurred cost, it does not accurately reveal the current financial position of firms.[4]

C. I-FIFO: Indexed FIFO differs from standard FIFO only insofar as it indexes the cost of beginning inventory. If the inflation rate to which the beginning inventory is indexed is equal to the rate of increase in inventory product prices, the indexed FIFO method is equal to the LIFO measure of CGS.

D. I-LIFO: Indexed LIFO is similar to Indexed FIFO insofar as it indexes the beginning inventory for inflation but differs in that it also adjusts the value of ending inventory by the inflation factor.

The following example illustrates the use of each of these methods for valuing the cost of goods sold (CGS) in three possible situations:

i) inventory unchanged,
ii) inventory depletion, and
iii) inventory accumulation.

We assume that inflation in inventory product prices is equal to π, the general inflation rate.

4/ In the U.S., tax laws require conformity between the inventory valuation systems for tax and financial records and this feature of LIFO acts as a disincentive to its adoption by firms. While the 1984 and 1985 tax proposals suggested dropping the conformity requirement and advocated the adoption of indexed FIFO, the 1986 Tax Act did neither.

TABLE 3(a): INFLATION AND VALUATION OF GOODS SOLD FROM INVENTORY

Inventory Assumption Method	(1) Constant Inventory	(2) Inventory Depletion	(3) Inventory Accumulation
I. Base case with zero inflation $\pi = 0$	BI=100 P=100 EI=100 CGAS= BI + P = 200 CGS= CGAS - EI = \$100	BI=100 P=100 EI=50 CGAS= \$200 CGS= CGAS - EI = \$150	BI=100 P=100 EI=150 CGAS= \$200 CGS= CGAS - EI = \$50
II.	20 percent Inflation, $\pi = 0.2$		
A. FIFO	BI=100 P'=\$120 EI'= EI(1+π)=120 CGAS=\$220 CGS= 220 -120 = \$100	BI=100 P'=\$120 EI'= EI(1+π)=60 CGAS=\$220 CGS= 220 -60 = \$160	BI=100 P'=\$120 EI'=50 +120 =170 CGAS=\$220 CGS= 220 -170 = \$50
B. LIFO	BI=100 P'=120 EI=100 CGAS=\$220 CGS= 220 -100 = \$120	BI=100 P'=120 EI=50 CGAS=\$220 CGS= 220-50 = \$170	BI=100 P'=120 EI'= 100 +60 =160 CGAS= \$220 CGS= 220-160 = \$60
C. I-FIFO	BI'=BI(1+π) =120 P' =120 EI'=EI(1+π) =120 CGAS= \$240 CGS= 240 -120 = \$120	BI'=BI(1+π)=120 P'=120 EI'=EI(1+π)=60 CGAS= \$240 CGS= 240 -60 = \$180	BI'=BI(1+π)= 120 P'=120 EI'=120 +50 =170 CGAS= \$240 CGS= 240 -170 = \$70
D. I-LIFO	BI'=BI(1+π) =120 P'= 120 EI'= EI(1+π) =120 CGAS= \$240 CGS= 240 -120 = \$120	BI'=BI(1+π) =120 P'= 120 EI'= EI(1+π) = 60 CGAS= \$240 CGS= 240 -60 = \$180	BI'=BI(1+π)= 120 P'= 120 EI'= 120 +60 =180 CGAS= \$240 CGS= 240 -180 = \$60
Notation: BI = Beginning Inventory, P = Purchases, EI = Ending Inventory CGAS = Cost of goods available for sale, CGS= Cost of goods sold			

The effect of each method of valuing CGS of a hypothetical firm is shown above. By assuming that revenue (net of other costs) is \$500 with π =0 and \$600 with $\pi = 0.2$, so that no other effects intrude on the problem, Table 3(b) illustrates the effect on taxable profit of each matrix entry above.

TABLE 3 (b): INFLATION, INVENTORY VALUATION, AND TAXABLE PROFIT

Inventory Ass. Method		(1) Inventory unchanged	(2) Inventory depletion	(3) Inventory accumulation	Comment
I.	Base case with zero inflation $\pi = 0$	Gross Profit = = \$500 - \$100 = \$400	Gross Profit = = \$500 - \$150 = \$350	Gross Profit = = \$500 - \$50 = \$450	Col.1-3 are base profit est.
II.	20 Percent Inflation, $\pi = 0.2$				
A.	FIFO	Gross Profit = \$600 - \$100 = \$500	Gross Profit = \$600 - \$160 = \$440	Gross Profit = \$600 - \$50 = \$550	None of col.are π-neutral
B.	LIFO	Gross Profit = \$600 - \$120 = \$480	Gross Profit = \$600 - \$170 = \$430	Gross Profit = \$600 - \$60 = \$540	Col.2 is not π-neutral
C.	I-FIFO	Gross Profit = \$600 - \$120 = \$480	Gross Profit = \$600 - \$180 = \$420	Gross Profit = \$600 - \$70 = \$530	Col.3 is not π-neutral
D.	I-LIFO	Gross Profit = \$600 - \$120 = \$480	Gross Profit = \$600 - \$180 = \$420	Gross Profit = \$600 - \$60 = \$540	All col. are π-neutral

Row I (when π=0) provides the base case estimates of gross profit against which to measure the neutrality characteristics of the four inventory valuation methods. If the taxable profit estimate under 20 percent inflation is exactly 20 percent greater than the level in the corresponding base case, the method is neutral to inflation. Notice that in the case where inventory is unchanged (column 1), LIFO, I-FIFO and I-LIFO provide an inflation-neutral estimate of profit. FIFO fails because it matches the older lower priced inventory against current revenues. LIFO however undervalues the ending inventory - this lowers the estimate of net worth of the firm.

In column 2 with inventory depletion both FIFO and LIFO fail to be neutral- LIFO in this case faces the problem that it values the amount of inventory depletion at the lower prices. FIFO, as before, undervalues the goods used from inventory but correctly values the inventory depletion because it attributes it to recent purchase. Both I-FIFO and I-LIFO provide inflation-neutral estimates of taxable profit under inventory depletion.

In column 3, the case where inventory accumulates, I-FIFO overestimates the cost of goods sold and underreports profit because part of ending inventory is still valued at the old price. I-LIFO proves accurate in this case as well because it avoids this particular problem. LIFO also provides an accurate estimate of taxable profit here but faces the problem that its ending inventory and therefore its net worth is undervalued. FIFO strikes out with respect to estimating profit in this third case as well and also underestimates the ending inventory (and thus, net worth).

Of the four methods tested, only I-LIFO appears to offer a consistently neutral estimate of taxable profit and ending inventory under the three possible situations assumed above: inventory unchanged, depleted or increased. We will demonstrate later that the technique for comprehensive balance sheet adjustment essentially recommends a form of I-LIFO.

(d). Capital Gains: In addition to the items discussed above, capital gains need to be indexed. The rationale for indexing capital gain is obvious and is that nominal gain may not be indicative of real gain with the result that a tax on nominal gain will increase the tax burden on firms that have sold assets. However, it is often argued that firms "buy and hold" assets till they are retired so that the capital gain 'realized' by firms through sale of capital assets is negligible.[5] Consequently, many analytical studies focus on the capital gain treatment in the personal income tax and ignore the corporate capital gain tax. Where this "buy and hold" assumption is not justified, the asset value needs to be adjusted for inflation.

One method that was discussed under depreciation deduction was the indexation of the undepreciated basis of the asset. Capital gain can then be calculated as the difference between amount realized from sale and the indexed undepreciated basis.

Another method involves a comprehensive adjustment (to be discussed below) under which the asset values are adjusted for inflation so that the balance sheet indicates the undepreciated basis to be deducted from the asset's sale price. Both methods ensure that real and not nominal gain is taxed.

5/ Hall (1981) notes that the capital gains tax is imposed upon realization of gain and is therefore a turnover tax. If an asset is held until it is retired it escapes the capital gains taxation entirely. Characterizing investment as a buy and hold action he justifies the irrelevance of the capital gains tax on capital goods.

(e). **Foreign Exchange Losses**: The appropriate adjustment of exchange losses and gains is rendered complex by considerations of the definition and treatment of risk. [6] The discussion below is therefore not complete but rather illustrates the elements of the problem in some simple and special circumstances.

A decrease in the exchange rate (dollars/peso, for example) causes an increase in the local currency (peso) amount due on foreign currency denominated debts. The increased peso payment to service the debt and repay the principal is called an 'exchange loss'. Corresponding to the same exchange rate adjustment, foreign asset holders experience an increase in peso receipts which is an 'exchange gain'. Firms and individuals who imported machinery, etc. before the change in the exchange rate also experience an exchange gain. What principles apply to the tax treatment of such exchange gains and losses in general, and especially under inflation? There appears to be less consensus on the appropriate treatment of this item than any other, even without the complication of inflation. One way of looking at the problem is to consider the factors underlying the exchange rate adjustment. We consider two such approaches below.

6/ In principle, where forward exchange markets exist, the risk of an exchange loss could be hedged by entering into a forward contract. A Colombian firm borrowing in dollars could arrange to buy dollars at the forward market rate on the date the loan matures. This would effectively eliminate the exchange rate risk.

A. Purchasing Power Parity and Exchange Rates: Typically, domestic inflation rates that are consistently in excess of inflation in the rest of the world provoke depreciation in the exchange rate (a decrease of the dollars per peso rate). The underlying basis for such adjustments is expressed by the Relative Purchasing Power Parity hypothesis which postulates that changes in the exchange rate are determined by changes in the domestic price level relative to that abroad. This suggests a principle for treating exchange gains and losses.

If the rise in the exchange rate is caused entirely by this differential inflation rate effect then it can be seen that an "exchange loss" does not involve any additional real peso cost. If local inflation is 20 percent per year while the creditor country has zero inflation then a 20 percent depreciation of the dollar/peso rate merely writes up the debt and interest due in peso terms by the rate of inflation. But these inflated local currency values correspond to the same real obligations as before. Since real costs have not increased, and taxation should consider real rather than nominal losses, no deduction of such costs is called for. Only the exchange loss in excess of the local inflation rate should be tax deductible.

Colombia uses an approximate method of making this correction by defining an "exclusion fraction" which is used to allow only a part of the financial cost of foreign debt to be deducted as a cost. The exclusion fraction (f) is given by:

$$f = \frac{\text{Local Inflation rate}}{\text{\% exch.rate adj + interest rate}}$$

Where the exchange rate adjustment is equal to the local rate of inflation this method allows approximate real exchange losses to be deducted.

B. Interest Rate Differentials and Exchange Rates: An alternate but related hypothesis was used by the U.S. Administration in its 1984 tax reform recommendations. The argument used was that differences in interest rates are offset by changes in the exchange rate between widely traded currencies. If interest rates in Japan are 5 percent when interest rates in the U.S. are 10 percent, then Japanese investing in U.S. financial markets would anticipate a 5 percent depreciation of the U.S. dollar. Alternatively, an American investor would find the Japanese market attractive only if he expects to get a 10 percent return - 5 percent in the form of interest rate and 5 percent in the form of anticipated exchange gain. This hypothesis is clearly not unrelated to the PPP argument since an inflation differential is consistent with anticipation of an exchange rate change and hence a willingness to accept an interest rate differential.

The report recommended treating exchange gain/loss as an increase/decrease of interest for tax purposes. "Anticipated" gain or loss was to be measured as the difference between the nominal yield on the foreign asset/liability expressed in the home currency and the market yield on an equivalent domestic asset/liability. Such anticipated gain/loss would be recognized on accrual while unanticipated gain/loss would be recognized on realization.

These explanations and suggested treatments deal with exchange rate changes caused by domestic inflacion. As noted at the outset this is a limited discussion of the phenomenon of exchange gains and losses. In principle, where forward exchange markets exist, the risk of an exchange loss could be hedged by entering into a forward contract. We do not discuss here the circumstances under which such risk reduction strategies are possible.

ii. Balance Sheet Adjustment

In contrast to the approach discussed so far which made appropriate inflation adjustments directly to items on the income statement, the approach to be discussed below begins by adjusting items on the balance sheet (both asset and liability values) and deriving taxable profit. This approach is intrinsically more comprehensive and yields, in addition to an inflation adjusted figure for profit, an accurate net worth statement, and the possibility of calculating real capital gain on the sale of depreciable assets.

(a). Net Worth Method

The adjustment of the balance sheet confronts directly the question of appropriate definition of income. A comprehensive definition of income is the Haig-Simons concept which measures income as the change in net worth plus dividend distribution.[7] Such a definition captures the accrued income from changes in the value of assets and liabilities. Under a regime of stable prices this measure of income can be readily derived. Inflation, however, renders both nominal balance sheet values and income flows inappropriate. What principles of adjustment will allow us to accurately measure real income and net worth of a firm under these circumstances?

To illustrate the effect of inflation on the balance sheet and income statement and to explain the appropriate adjustments we develop a series of examples below. Common to these examples are some assumptions. The firm (unless otherwise indicated) holds a non-depreciable asset (land),

---

7/ The corresponding definition of income for individuals is change in net worth plus consumption. We assume, for expositional simplicity, that firms do not distribute dividends.

financed by borrowing at a real interest rate of 5 percent. Its initial balance sheet is represented by (A_0, L_0) where A denotes Assets and L denotes Liabilities and Net Worth. To allow comparison with the earlier discussion of direct adjustment of the income statement we use the same numerical example as in table 2.

First, balance sheet items are classified as monetary or non-monetary- the latter's nominal values change with inflation while the nominal values of monetary items stay fixed. Thus real or indexed assets and liabilities and net worth are non-monetary items while unindexed debts and receivables and cash are monetary items. The balance sheet identity is:

$$NMA + MA = ML + NML + NW$$

1. Zero Inflation case: We begin by reviewing the relationship between the balance sheet and the income statement for a case of stable prices. Consider the following end-of-period 0 balance sheet (A_0, L_0) which consists of monetary and non-monetary assets (MA_0 and NMA_0, respectively), and monetary and non-monetary liabilities (ML_0 and NW_0).

TABLE 4

BALANCE SHEET, Period 0

ASSETS	A_0	LIABILITIES	L_0
MA_0	0	1000 ML_0	
NMA_0	1000	0 NW_0	
A_0	1000	1000 L_0	

INCOME STATEMENT, Period 1

Revenue	1000
Wages	500
Materials	100
Interest	50
Cash Expenses	650
Cash Flow Pre-tax	350

The firm's income statement reflects its revenues and expenses in period 1. The pre-tax cash flow from period 1 transactions is given by the difference between cash revenue and cash expenses. This cash flow could be used to pay taxes, purchase assets, retire liabilities, pay dividends, or add to cash balances. Assume that the firm holds the entire cash flow in cash balances.

The end-of-period 1 pre-tax balance sheet, denoted by (A_1', L_1') can be derived by adjusting the firm's MA_0 value by the amount of cash flow. NMA_0 is reduced by the amount of depreciation (assumed to be zero because the asset in this example is land, a non-depreciating asset), while ML_0 is unchanged. The new net worth NW_1' is then derived as a residual; $NW_1' = MA_1' + NMA_1' - ML_1'$. The firm's income is then derived as the change in net worth; $(NW_1' - NW_0)$.

BALANCE SHEET, Period 1

ASSETS	A_1'	LIABILITIES	L_1'
MA_0+Cash Flow = MA_1'	350	1000 ML_1'	
NMA_0-Deprec.= NMA_1'	1000	350 $NW_1' = A_1' - ML_1'$	
A_1'	1350	1350	L_1'

Income in period 1
$= NW_1' - NW_0$
$= 350 - 0 = 350$

Finally, the balance sheet can be adjusted by reducing MA_1' by the amount of tax liability to get MA_1. Net worth after tax (NW_1) is reduced correspondingly so that (NW_1-NW_0) reflects after tax income.

After-Tax
BALANCE SHEET, End of Period 1

		ASSETS	A_1	LIABILITIES	L_1
Tax liability	MA_1'-Tax =	MA_1	175	1000	ML_1
= τ.(Income)					
		NMA_1	1000	175	$NW_1 = A_1 - ML_1$
= 0.5.(350) =175					
Net Income					
= (NW_1 - NW_0) = 175		A_1	1175	1175	L_1

The example above indicates the close flow-stock relationship between the income statement and the balance sheet. While in this example changes in the value of balance sheet items were due entirely to <u>realized</u> income reflected in the income statement we can conceive of independent changes in the balance sheet items which generate <u>accrued</u> income or expense. More relevant to our discussion, the effect of inflation in generating accrued gains on nominal liabilities and losses on nominal assets would be captured more naturally in a Haig-Simons measure of income by using a balance sheet based calculation.

2. Non-Zero Inflation Case: The income statement deals with realized values[8] and yields realized income. However, under inflation, there may be a substantial component of income which is accrued but not realized so that the income statement will underestimate Haig-Simons income. Put in other words, the conventional income statement does not recognize all possible sources of Haig-Simons income whereas an "appropriate" balance sheet approach does.

The principles of such an "appropriate" balance sheet adjustment and the derivation of company income may be set out as follows:

Step 1: Adjust (A_0, L_0) to (A_0', L_0') by revaluing non-monetary assets and liabilities.

Step 2: Add pre-tax cash flow to (A_0', L_0') to derive (A_1', L_1').

Step 3: Calculate $(NW_1'-NW_0')$ to get total (taxable) income.

Step 4: Apply tax rate to $(NW_1'-NW_0')$ to estimate tax liability. Adjust (A_1', L_1') by tax liability to derive (A_1, L_1). Now (NW_1-NW_0') will indicate after-tax income.

It can be easily seen that the only difference between the scheme above and the no-inflation balance sheet case considered earlier is the addition of an intermediate step- the calculation of (A_0', L_0')-which revalues non-monetary assets and liabilities (NMA and NML) by the inflation factor $(1+\pi)$.

8/ This is not entirely accurate since a depreciation charge is an accrued cost and is usually part of the income statement.

The examples below illustrate the application of this principle and the step-wise adjustments indicated. The effect of different balance sheet structures and the appropriate adjustments are shown for three cases:

a) a firm holding monetary liabilities,

b) a firm with a depleted stock of inventory, and

c) a firm with both depreciable assets and monetary liabilities.

To facilitate comparison with the examples developed earlier, case (a) and (b) use the same data as in table 2 and column 2 of table 3, respectively.

Case a: The firm is assumed to be holding a non-depreciable asset and a balancing amount of a monetary liability.

TABLE 5

BALANCE SHEET, End of Period 0

ASSETS	A_0	LIABILITIES	L_0
MA_0	0	1000 ML_0	
NMA_0	1000	0 NW_0	
A_0	1000	1000	L_0

INCOME STATEMENT, Period 1

Revenue	(1000)	1200
Wages	(500)	600
Materials	(100)	120
Interest	(50)	260
Cash Expenses	(650)	980
Cash Flow Pre-tax	(350)	220

( ) figures indicate values for zero inflation.

STEP 1:

ADJUSTED BALANCE SHEET, Period 0

	ASSETS	A_0'	LIABILITIES	L_0'
	MA_0'	0	1000	ML_0'
$NMA_0.(1+\pi)$ =	NMA_0'	1200	0	$NW_0' = NW_0.(1+\pi)$
	A_0'	1200	1000	L_0'

Inflation adjustment of the balance sheet involves first revaluing non-monetary assets and liabilities. Here NMA and net worth are revalued.

Notice that at this stage A_0' and L_0' do not balance.

STEP 2:

BALANCE SHEET, Period 1

	ASSETS	A_1'	LIABILITIES	L_1'
MA_0'+Cash Flow =	MA_1'	220	1000	ML_1'
NMA_0'-Deprec.=	NMA_1'	1200	420	$NW_1' = A_1'-ML_1'$
	A_1'	1420	1420	L_1'

STEP 3:

Income in period 1

$= NW_1' - NW_0$

$= 420 - 0 = 420$

Tax liability

$= \tau\ (NW_1'-NW_0')$

$= 0.5\ (420) = 210$

STEP 4:

After-Tax
BALANCE SHEET, End of Period 1

ASSETS	A_1	LIABILITIES	L_1
MA_1'-Tax = MA_1	10	1000	ML_1
NMA_1	1200	210	$NW_1 = A_1 - ML_1$
A_1	1210	1210	L_1

Net of tax income
$= (NW_1 - NW_0') = 210$

In this simple example, the adjustment of the balance sheet yields:

i. a balance sheet where all real assets and liabilities including net worth are carried at inflation-adjusted cost.

ii. a measure of income (420) that is greater than income without inflation (350) by the same percentage as the rate of inflation (20%). This shows that income measured is inflation-neutral.

Notice that the problem of income measurement in this example was due to nominal interest deduction under conditions of inflation. The net worth adjustment ensured that the accrued income from the decline in value of ML under inflation was captured in the measure of income.

Case b: The example below illustrates the treatment of goods sold from inventory. To focus on th's problem and to abstract from depreciation etc., we assume, as in the previous case, that land is the only other asset. On the liability side of the balance sheet the firm has no liabilities so that net worth is the only entry.

TABLE 6

BALANCE SHEET, End of Period 0

ASSETS	A_0	LIABILITIES	L_0
MA_0 Cash	0	0	ML_0
NMA_0			NW_0
Land	2000	2100	Net Worth
Inventory	100		
A_0	2100	2100	L_0

INCOME STATEMENT, Period 1

Revenue	(1000)	1200
Wages	(500)	600
Materials	(100)	120
Inventory Depletion	(50)	60
Cash Expenses	(600)	720
Cash Flow Pre-tax	(400)	480

STEP 1

ADJUSTED BALANCE SHEET, Period 0

ASSETS	A_0'	LIABILITIES	L_0'
MA_0'	0	0	ML_0'
NMA_0'			
Land	2400	2520	NW_0'
Inventory	120		
A_0'	2520	2520	L_0'

The balance sheet (A_0', L_0') is obtained by revaluing the NMA and NW items by the inflation factor.

STEP 2

Before Tax BALANCE SHEET, Period 1

ASSETS	A_1'	L_1'	LIABILITIES
MA_1'	480	0	ML_1'
NMA_1'		2940	NW_1'
Land	2400		
Inventory	60		
A_1'	2940	2940	L_1'

STEP 3

Income in Period 1

$= NW_1' - NW_0'$

$= 2940 - 2520$

$= 420$

Tax liability

$= 0.5\ (420) - 210$

STEP 4

After Tax BALANCE SHEET, Period 1

ASSETS	A_1	L_1	LIABILITIES
MA_1	270	0	ML_1
NMA_1		2730	NW_1
Land	2400		
Inventory	60		
A_1	2730	2730	L_1

Net Income in Period 1

$= NW_1 - NW_0'$

$= 2730 - 2520$

$= 210$

The net worth adjustment therefore yields a measure of taxable income of 420 and after-tax income of 210.

Case c: In the example below we assume the firms holds two kinds of depreciable assets and both indexed and monetary liabilities. This allows us to consider a more full fledged case to illustrate the balance sheet and income statement correction for inflation. In the example, the two real assets, equipment and building, are assumed to face straight line depreciation rates of 25 percent and 10 percent, respectively. In addition, the firm has two different kinds of liabilities - an indexed debt of $500 and an unindexed debt of $500. A real interest rate(r) of 5 percent is assumed, as before, for the case of indexed debt while for unindexed debt the nominal rate(i) is given by: i = 26 percent at π= 20.

TABLE 7

BALANCE SHEET, End of Period 0				INCOME STATEMENT, Period 1		
ASSETS A_0		LIABILITIES L_0				
				Revenue	(3000)	3600
MA_0 Cash	0	500	ML_0	Wages	(1000)	1200
			NML_0	Materials	(500)	600
NMA_0		500	Indexed Debt			
Equipment	500		NW_0	Interest Payment	(50)	160
Building	1000	500	Net Worth			
A_0	1500	1500	L_0	Cash Expenses	(1550)	1960
				Cash Flow Pre-tax	(1450)	1640

In this example the net worth adjustment corrects for the overstatement of the firm's cost of nominal debt and the understatement of income that would result. At the same time, the understatement of depreciation that occurs under historic cost accounting is avoided by the revaluation of assets that is part of the same net worth adjustment.

STEP 1 ADJUSTED BALANCE SHEET, Period 0

ASSETS	A_0'	LIABILITIES	L_0'
MA_0'	0	500	ML_0'
NMA_0'			NML_0'
Equipment	600	600	Indexed Debt
Building	1200		NW_0'
		600	Net Worth
A_0'	1800	1700	L_0'

The balance sheet (A_0', L_0') is obtained by revaluing the NMA and NW items by the inflation factor.

Notice that this revalued sheet does not balance because accrued income is not yet recognized.

STEP 2

ASSETS	A_1'	L_1'	LIABILITIES
MA_1'	1640	500	ML_1'
			NML_1'
NMA_1'		600	Indexed Debt
Equipment	450		NW_1'
Building	1080	2070	Net Worth
A_1'	3170	3170	L_1'

STEP 3

Income in Period 1

$= NW_1' - NW_0'$

$= 2070 - 600$

$= 1470$

Tax liability

$= 0.5\ (1470) = 735$

STEP 4

ASSETS	A_1	L_1	LIABILITIES
MA_1	905	500	ML_1
			NML_1
NMA_1		600	Indexed Debt
Equipment	450		NW_1
Building	1080	1335	Net Worth
A_1	2435	2435	L_1

Net Income in Period 1

$= NW_1 - NW_0'$

$= 1335 - 600$

$= 735$

(b). Equivalent Adjustment Methods

There are essentially three basic variants of the balance sheet based approach to inflation adjustment. These three variants are:

1. the net worth method, $(NW_1'-NW_0')$
2. the net monetary liability adjustment, $\pi.(ML_0-MA_0)$
3. the net real (non-monetary) asset method, $\pi.(NMA_0-NML_0-NW_0)$.

The net worth method has been described at length in the previous section. By revaluing the initial balance sheet and adding in the gross cash flow from the current income statement it derives both an inflation-adjusted balance sheet and an estimate of gross and net income.

The net monetary liability adjustment consists of adding the accrued income from the decline in value of net monetary liability to conventionally reported income. Where the firm also holds depreciable assets, the reported income has to be adjusted for the indexed value of depreciation. This method can therefore be said to provide an adjusted measure of gross income by calculating:

Pre-tax cash flow - Indexed Depreciation + $\pi.(ML - MA)$

The net non-monetary asset adjustment consists of making a similar addition to the net of pre-tax cash flow and indexed depreciation, i.e.:

Pre-tax cash flow - Indexed Depreciation + $\pi.(NMA - NML - NW)$

These two methods provide identical values for income and balance sheet items to the net worth method. The equivalence of the three methods is demonstrated in Appendix A where both a general proof and two specific examples are worked out. Here we will quickly demonstrate that method (2) and (3) are identical. The equivalence of these two methods of adjustment follows from the balance sheet identity written in terms of monetary and non-monetary items, where net worth is considered non-monetary:

$$NMA + MA = ML + NML + NW$$

and so $$NMA - NML - NW = ML - MA$$

It can quickly be seen that method (2) and (3) are equivalent since adding the decline in the value of net monetary liability due to inflation (= $\pi(ML-MA)$) to the firm's unadjusted income is equivalent to adding the increase in value of net non-monetary assets (= $\pi(NMA-NML-NW)$) to the same income.

(c). Methods used in various countries[9]

Given the equivalence of these three methods of adjustment it becomes clear that a number of countries, which appear to have differing adjustment rules in place, do not in fact differ in principle. Thus Argentina, Iceland and Uruguay define a net adjustment to income given by the inflation rate (π) multiplied by the net monetary liability (ML - MA) of the firm. Brazil adjusts reported income by the product of π and net real assets (NMA - NML - NW). Israel does something similar but calls the real assets 'protected' assets. Chile, which is widely acknowledged to have the most sophisticated inflation adjustment rules, defines its adjustment in terms of the difference in end-of-year and beginning-of-year net worth, i.e. $(NW_1' - NW_0')$.

While there is some difference in the effective inflation adjustment across these countries, this is due to differences in the specific definitions of what is 'real' and what is 'monetary' rather than differences in the principles of adjustment. Brazil, for example, treats

---

9/ Appendix B provides a more detailed description of the rules of adjustment in 8 countries where balance sheet based methods are employed.

inventory as a monetary asset, as does Argentina, while Chile allows inventory to be included in the revaluation of assets (see box). Israel excluded machinery and assets from the list of 'protected' and therefore adjustable assets while at the same time not indexing depreciation.

Adjustment Rules in Chile: The Chilean rules of inflation adjustment and income estimation are similar to the net worth method discussed above. The relevant balance sheet items are revalued by the inflation factor, depreciation is calculated on the revalued undepreciated basis, and net worth NW_1' is derived. Taxable income is then calculated as the difference between NW_1' and NW_0'.

This comprehensive system of adjustment in Chile was arrived at after a number of years of using various partial and irregular methods. In the 1940s firms were allowed to occassionally revalue fixed assets. In the 1950s the revaluation was made more regular and was sometimes extended to include inventory. A net worth based partial adjustment system was used between 1959 and 1974. Only since 1974 has the comprehensive system of adjustment been used to adjust income for inflation. Indexation has been developed with a view to prevent tax distortions, maintain compliance, and preserve tax elasticity.

Unlike most other countries with inflation adjustment systems, balance sheets in Chile are adjusted both for tax purposes and also for financial statement purposes. As the net worth exercises above demonstrated, financial statements are the basis for determining taxable income in Chile. Monetary correction is mandatory for financial statements and the same corrections are valid for tax and financial records. The only exceptions to this are entities such as small taxpayers who do not maintain regular accounts.

iii. The Effects of Partial Indexation

(a). Issues

In principle, comprehensive indexation, either of the balance sheet or the income statement, is required to avoid erosion of and distortions to the company income tax base induced by inflation. However, the administrative complexity of some of the adjustments may preclude full indexation or render it unworkable. Often it proves politically easier to pass tax reforms that introduce indexation to maintain the real value of deductions to taxpayers (such as capital gain) while attempts to similarly index the liability side run into political constraints. In such cases we require some understanding of the effect of various partial or imperfect provisions on the marginal effective tax rate (METR) and the extent to which it remains influenced by the rate of inflation.

If the tax authorities index the asset side of the balance sheet by allowing depreciation deductions to be inflation-adjusted but fail to index the liability side and continue to allow nominal interest deductions, is there an improvement relative to a situation where both sides are unindexed? What if interest were indexed but depreciation deductions were not? How important is it to include inventory and capital gain in the inflation adjustment package? We would expect to find that our answers to these and other questions depend on the rate of inflation and the company tax rate.

In many countries the rules in place are ad hoc and incomplete adjustments to selected items in the income statement. In the U.S., preferential taxation of capital gain is justified with the argument that this acts as a rough correction of the overstatement of capital gain. The Treasury-I tax reform proposals noted that this is a very imperfect

correction because it leads to overtaxation at high rates of inflation, it taxes nominal gains even when in real terms the taxpayer has a capital loss, and it biases investment decisions towards assets that offer returns in terms of asset appreciation rather than dividends or interest. Similarly, firms are sometimes allowed accelerated depreciation deductions to offset the effect of inflation. This too is an inappropriate adjustment since it is an effective offset only at a particular rate of inflation and for certain firms.

Bernard and Hayn (1986) have argued that allowing nominal interest cost deductions (in addition to accelerating tax depreciation and allowing investment tax credits) while not indexing depreciation may be mutually offsetting and, in the case of the U.S., may have kept constant the real tax burden on corporations taken as a group. If this is so it is indeed fortuitous but such ad hoc measures cannot be the basis for policy in economies subject to high rates of inflation. Even if it were the case in the aggregate, such a crude offset would conceal tremendous disparity in the effect of inflation on individual firms and industries. In fact, the Bernard-Hayn study confirmed that the dispersion of real effective tax burdens across industries was magnified under these ad hoc adjustments.

Aaron and Galper (1985) noted that a partial solution which indexes some and not all of these items runs the risk of introducing new distortions. As an example they cited the case where capital gain is indexed but interest expenses are not, thereby creating an infinite tax loophole. Borrowing to finance the purchase of appreciating assets is made attractive since the nominal interest expense is tax-deductible and only the real capital gain is taxed.

(b). METR Effects of Partial Indexation

To understand the effect of partial indexation provisions on the marginal effective tax rates we use a simulation model due to Pellechio (1986). Three cases are considered for a firm with varying levels of debt and depreciable asset shares. A later section also reviews work done by Fullerton (1987).

1. Simulation Results: The following estimates of METR are based on Pellechio's model and assume a statutory tax rate of 40 percent and taxation of nominal capital gain. The METRs are calculated for full and partial indexation of economic depreciation and interest, at 3 different rates of inflation. The model assumes away the valuation problems due to cost of goods sold and the holding of foreign currency liabilities and assets.

TABLE 8: Case A-Inflation and Marginal Effective Tax Rates

Inflation Rate (%)	Depreciation Unindexed	Deduction Indexed	Interest Deduction
10	51.5^{x}	27.1^{a}	Unindexed
	67.5^{o}	42.8^{i}	Indexed
50	77.8^{x}	35.1^{a}	Unindexed
	99.1^{o}	54.9^{i}	Indexed
100	87.7^{x}	44.1^{a}	Unindexed
	105.9^{o}	61.3^{i}	Indexed

Note: The superscripts classify the four different cases.
x = both depreciation and interest are not indexed.
i = both depreciation and interest are indexed.
o = interest is indexed but depreciation is not.
a = depreciation is indexed but interest is not.
The figure on the next page uses this notation to plot the various cases.

Case A- 50% Debt Finance: The table above indicates the METR for a 50% debt financed investment, with inflation at a constant 10, 50 or 100 percent rate, and a statutory company tax rate of 40 percent. The asset composition is land 10%, building 40%, machinery and equipment 40%, and vehicles 10%.

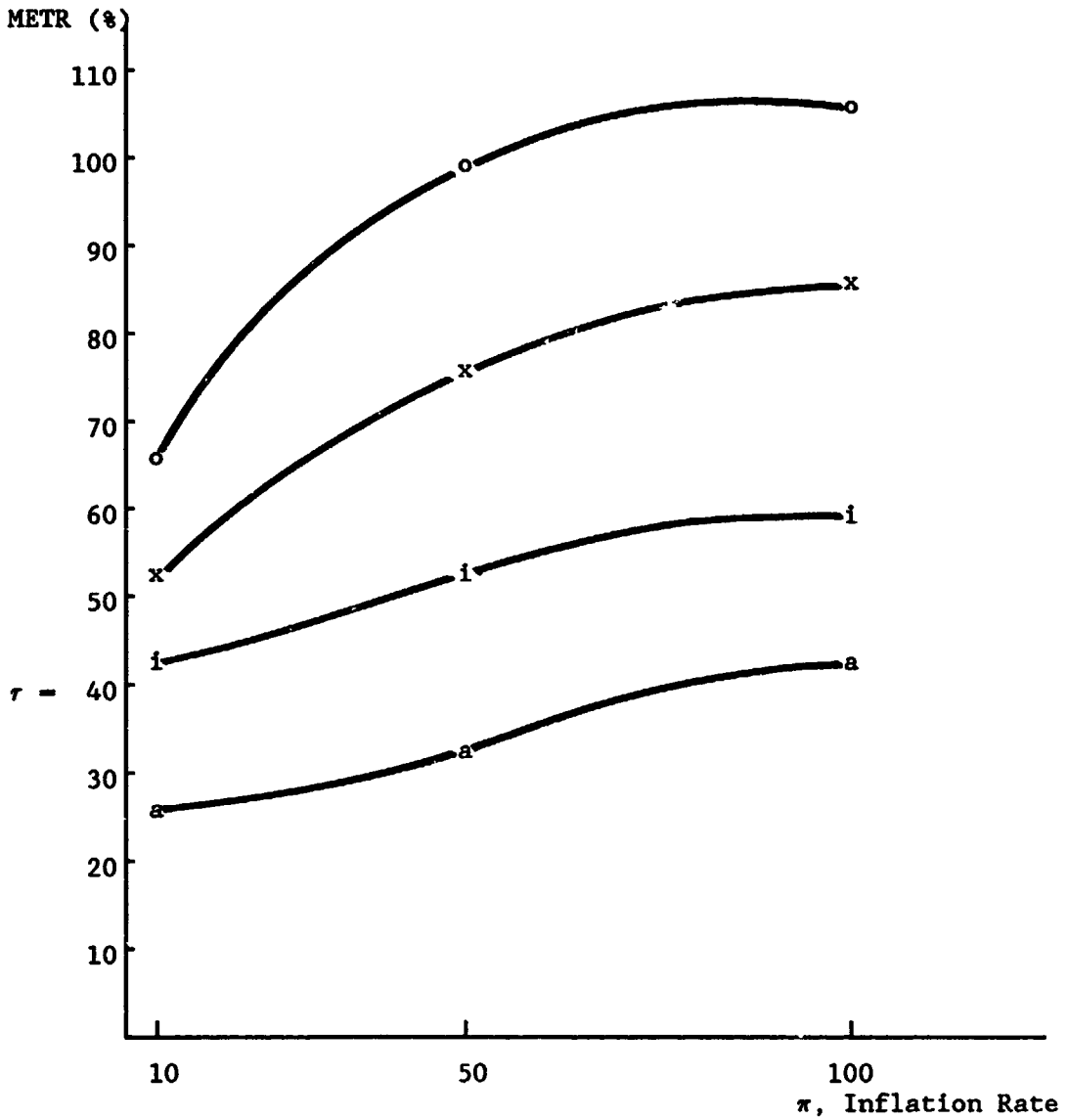

FIGURE 1: INFLATION AND THE MARGINAL EFFECTIVE TAX RATE

Some constant patterns are evident. First, as we would expect, the METR is greatest when interest is indexed but depreciation is not and

lowest when depreciation is indexed but interest is not. In the latter case, the nominal interest deduction provides a subsidy which lowers the effective rate below the statutory rate, $r = 40$ percent. Second, for all rates of inflation, the METR is higher when neither item is indexed relative to when both interest and depreciation are indexed. The differential in the METR for these two cases appears to widen at higher rates of inflation.

Notice that the METR and the statutory tax rates differ, even when both interest and depreciation are indexed, because of the taxation of nominal capital gain. At an inflation rate of 100 percent the taxation of nominal capital gain causes the differential between statutory and effective rates to widen to 21.3 percent.

Even at a 10 percent inflation rate the effects of partial indexation are dramatic. Indexing depreciation but not interest, relative to the situation where both are unindexed reduces the METR from 51.5 to 27.1 percent. Allowing firms to deduct nominal interest expenses while adjusting the asset side for inflation dramatically reduces the effective tax on the investment. This effect would be stronger for firms that have a higher debt to equity ratio than the 50 percent assumed here. On the other hand, indexing interest but not indexing depreciation causes the METR to rise from 51.5% to 67.5%, an effect due to the reduced value of interest deductions. The effect of the four different combinations on the METR at different rates of inflation is indicated in the graph above.

Case B- 75% Debt Finance: The effect of inflation on METRs in cases where debt is a larger proportion of asset finance is indicated in the following table where debt constitutes 75 percent of the financing proportion. Since such high leverage situations are common in developing countries, these numbers provide useful information on the effect of inflation on METRs.

TABLE 9: Case B - Inflation and Marginal Effective Tax Rates

Inflation Rate (%)	Depreciation Unindexed	Deduction Indexed	Interest Deduction
10	49.3^{x}	27.0^{a}	Unindexed
	74.8^{o}	43.5^{i}	Indexed
50	73.5^{x}	31.5^{a}	Unindexed
	105.5^{o}	56.6^{i}	Indexed
100	85.0^{x}	40.0^{a}	Unindexed
	110.3^{o}	62.9^{i}	Indexed

Note: Assets are financed by 75% debt.

To see the effect of higher debt-equity ratios compare table 8 and table 9. Notice that the METRs are lower, when interest is unindexed, for the case where debt is a higher proportion of financing. Thus, at a 50 percent rate of inflation, the METR with interest unindexed but depreciation indexed is 35.1% with 50% debt, whereas the METR with 75% debt is 31.5%. This reduction of the METR clearly occurs because of the additional benefit of nominal interest deduction on a larger base. Correspondingly, the effect of indexing interest is to raise METR by a greater amount in the case of higher debt financing. Thus indexing interest raises METR from 35.1% to 54.9% in the 50% debt case but the increase is greater, from 31.5% to 56.6%, in the case of 75% debt.

Case C- Lower share of Depreciable Assets: Comparing table 8 and table 10 (which differ only in that table 10 represents a firm with a lower proportion of depreciable assets) notice that higher inflation raises METRs by less when a firm has a smaller proportion of depreciable assets in its portfolio and depreciation deductions are not indexed. Indexing depreciation takes away this relative advantage so that inflation raises METR by more. At any given rate of inflation the effect of indexing depreciation deductions is to lower METR by more in the case where the firm has a larger fraction of depreciable assets.

TABLE 10: Case C - Inflation and Marginal Effective Tax Rates

Inflation Rate (%)	Depreciation Unindexed	Deduction Indexed	Interest Deduction
10	49.9^{x}	31.3^{a}	Unindexed
	76.5^{o}	55.3^{i}	Indexed
50	66.4^{x}	39.9^{a}	Unindexed
	96.8^{o}	66.5^{i}	Indexed
100	73.5^{x}	48.3^{a}	Unindexed
	96.8^{o}	69.5^{i}	Indexed

Note: This table assumes that the firm holds a lower proportion of depreciable assets. The asset composition is land 40%, building 40%, machinery & equipment 20%, vehicles 0%. Assets are 75% debt financed.

2. Inflation and METRs in the U.S.: In recent years attempts to introduce inflation indexation in the U.S. tax system failed inspite of well argued proposals. Fullerton (1987) provides evidence of the effect on the METTR of the various proposals: "pure" and approximate indexation of interest, the repeal of investment tax credits, indexation of capital gains, and reduction in company and personal income tax rates. The following table indicates his results.

TABLE 11: MARGINAL EFFECTIVE TOTAL TAX RATES (%)

Item	1985 Tax Laws	Various Proposals Considered One at a Time					
		IntIndex Approx.	IntIndex Pure	Repeal ITC	Index CapGain	Lower Tax Rate Corp.	Lower Tax Rate Person.
Equipment	-18.0	9.5	5.8	36.1	- 19.5	-5.9	-25.1
Structures	37.4	44.8	43.3	37.4	36.8	36.7	35.8
Inventory	41.6	51.2	49.6	41.6	40.9	40.7	39.3
CorpTotal	29.4	40.9	39.0	39.7	28.6	30.1	26.7
Overall*	26.8	31.7	30.8	30.7	26.6	27.8	25.2

Note: The statutory tax rate under the 1985 Tax Law was 46 percent.

The existing U.S. tax laws in 1985 indexed neither depreciation nor interest and taxed nominal capital gain while allowing 60 percent of the long term gain to be excluded from taxation. They did provide for accelerated depreciation and, in addition, awarded investment tax credits to equipment investment which rendered the effective tax rate on equipment negative. The first column of numbers in Table 11 provides the base case for this set of tax rules.

The approximate indexing of interest deductions suggested by the Treasury (excluding a fraction equal to $\pi/(0.06 + \pi)$ of nominal interest, where π is the rate of inflation) has the effect of significantly increasing the METTR on individual assets, on corporations and the overall rate. At the 4 percent rate of inflation assumed by Fullerton, the "pure" indexation scheme does not lead to very different effective tax rates so that the approximation seems justified on administrative grounds.

The repeal of investment tax credits (ITC) has a similar significant effect on tax rates but has the added benefit of leveling the METR across assets by raising the METR on equipment. Reducing the corporate tax rate has a direct effect of lowering the METR but it also generates two offsetting effects on the METR; the lower tax rate reduces the benefits of nominal interest deduction and accelerated depreciation. In the table, this offset appears to be quite complete as the METR overall and on corporations as a whole is raised slightly, the METR on equipment rises appreciably, and the others decline marginally. The indexation of capital gains lowers effective tax rates slightly but Fullerton suggests that this effect may be stronger at higher rates of inflation.

While 1985 U.S. tax laws permitted LIFO inventory accounting, the conformity requirement between tax and financial accounting made this an unattractive option and firms took advantage of this for only a small fraction(30%) of inventory. Fullerton estimates that the METR on inventory adjusted for this was closer to 60 percent rather than 41.6 percent indicated in the table under the old 1985 rules.

Some more insight can be had from considering the effect of the 1985 U.S. tax rules, the Treasury and President's proposals, and the final 1986 version on the METR and its behavior with inflation. The following

table, based on Fullerton's study, describes the characteristics of these four different tax packages in terms of the their provisions for indexing depreciation, interest, capital gain, and inventory, etc. Fullerton's study considered the effect on the METR of fairly moderate rates of inflation (0 to 10 percent) but even at these levels the effect on the METR is clear.

TABLE 12: U.S. TAX REFORM PROPOSALS, INFLATION, & THE METR

Item	1985 Tax (Original)	1986 Tax (New Law)	1984 Treasury Proposal	1985 President's Proposal
CorpTax Rate (%)	46	34	33	33
Depreciation	Unindexed Acceleratd	Unindexed Accelerated	Indexed Economic Dep.	Indexed Accelerated
Interest	Unindexed	Unindexed	Indexed (approximate)	Unindexed
Capital Gain	Unindexed 60% Long Term Gain Excluded	Unindexed Lower Pers. Tax (15,28%) No Exclusion	Indexed Lower Personal Tax, No Exclusion	Unindexed Lower Personal Tax 50% Exclusion
Inventory	LIFO but financial conformity required	LIFO but financial conformity required	LIFO w/o conformity & Indexed FIFO	LIFO w/o conformity & Indexed FIFO
Invest. TaxCredit	Allowed on Equipment	Repealed	Repealed	Repealed
Dividend	No Deduct.	No Deduction	50% deduction	10% deduction
System Character	No Indexation	No Indexation	Full Indexation	Partial Asset Indexation (Dep. and Inventory)
Inflation Effect on METR	METR rises with inflation	METR rises but less rapidly due to lower tax rates	METR <u>almost</u> unaffected by inflation	METR falls with inflation due to unindexed interest but more slowly due to lower tax rates

Table 12 indicates the important characteristics of the existing tax system in 1985, the tax rules that now apply as a result of the 1986 reforms, and the two proposals from the Treasury and the President's office, respectively. Of the four, the Treasury proposal comes closest to full indexation of the income statement - it included indexation of depreciation deductions, an approximate adjustment of interest expense, LIFO and Indexed FIFO options for inventory, and indexation of capital gain. The President's proposal dropped indexation of interest because of political problems with what was perceived as taxation of unrealized gain. Capital gain was also left unindexed but inventory and depreciation adjustments survived in a modified form.

The 1985 tax system provided for accelerated depreciation and 60 percent exclusion of long term capital gains, both of which, as we have indicated earlier, are crude adjustments. Interest was unindexed and the conformity requirement prevented firms from using LIFO accounting. The 1986 system made no changes to this except to remove the 60 percent exclusion of long term capital gain. The two proposals and the 1986 law recommended lower tax rates and the effect of the 1986 tax rules derives almost entirely from this and the repeal of investment tax credits since none of the indexation measures were approved.

Fullerton estimated the effect of each of the 4 tax systems on the METR when inflation was below 10%. Whereas under the 1985 tax rules the METR increased with inflation (once we take account of the effect of the LIFO conformity requirement), with the 1986 tax laws this effect was reduced by the lower tax rate. The Treasury proposal would have substantially neutralized the effect of inflation on the METR whereas the non-indexation of interest in the President's proposal would have led to the METR declining with inflation.

iv. Periodic Adjustment

The option of making inflation adjustments on a less than annual basis (i.e. every three or four years) is a less preferred alternative and it is hard to imagine the circumstances under which this is appropriate. Income statements, balance sheet reports, and income tax accounting all function on an annual cycle so that a system of inflation adjustment that diverges from that periodicity will create administrative and accounting awkwardness. Also, since a large part of the cost of administering an inflation adjustment system is set-up cost, periodic adjustment does not economize on administrative cost. Such adjustment will discriminate against short-lived assets and may create artificial incentives to time the acquisition and sale of assets and liabilities.

v. Administration of Inflation Adjustments

Much of the above discussion has revolved around the conceptually correct adjustments to income. The problem of implementing these adjustments is, however, a serious constraint that will often determine the actual scope of inflation indexation. Any comprehensive balance sheet based adjustment presumes the existence of accounting traditions in the private and public sector.

Reviewing the experience of Chile, Casanegra de Jantscher (1984) noted that a comprehensive inflation adjustment system is more equitable than a partial adjustment scheme but this is achieved at the cost of more difficult tax administration. However, at the high rates of inflation experienced by Chile, a partial adjustment system would have reduced taxpayer compliance and tax equity.

The experience of Israel is less encouraging and Yoran attributes the failure of the LTDIC to administrative complexity. Some of this has to do with the specifics of the adjustment rules in Israel which excluded some assets and thereby impaired the fairness and simplicity of the system.

Chile arrived at its current comprehensive adjustment system after lengthy experience with simpler, partial methods. Israel also went through the process of using partial adjustment, then moving to a comprehensive adjustment when inflation increased to over a 100 percent. The two experiences suggest that the rules of adjustment must be consistent with the capacity of the taxpayers and the tax authorities to follow/administer the rules.

III. THE CASH FLOW TAX APPROACH

One of the benefits of defining the company tax base in terms of the firm's cash flow is the implicit inflation neutrality of this measure. This feature of the cash flow base is due to the fact that all the values involved in the cash flow calculation for a given year are current money values. All inflows and outflows are valued in current dollars, so that the problem of comparability of costs incurred in different time periods is not encountered. Whereas the conventional income tax base, as we have seen, requires considerable amendment by way of indexation and revaluation provisions, the cash flow base avoids the mismeasurement of the base and the need for such adjustments even at fairly high rates of inflation.

1. Tax Base Definition

The cash flow base for businesses can be defined in a number of alternate ways.[10] The Real cash flow base (r-base) is defined as the difference between all sales of goods and services and purchases of goods and services (from employees and other firms), excluding financial flows such as interest paid and received and dividend payments. A second definition is the Real plus Financial (r+f) cash flow base, defined as the difference between all cash receipts (excluding proceeds from the sale of stock but including borrowing) and all expenditure (on labor, intermediate goods, and capital assets, and including interest and principal payments but not dividend distributions). A third cash flow base is the flow given by the sum of dividend and tax payments minus the proceeds from sale of

---

10/ The cash flow tax base for individuals is defined as the difference between all cash receipts (including receipts in kind) and all cash saving (consisting of payments into qualified accounts).

shares in that period, which is referred to as the Net Equity Distribution or the Stock (s-base) base. The s-base is identical to the (r+f) base, an equivalence which follows from the sources and uses of funds identity:

Sources		Uses
R + B + S	=	W + I + P + D + T

where R = Revenue, B = Borrowing net of loans and repayments, S = Share (own and other) sale proceeds net of share purchases, W = Wage and interm. input costs, I = Investment net of asset sales, P = Net Interest payments, D = Dividend distributed less dividend receipts, T = Taxes paid.

The real cash flow base is given by:

$$TB(r) = R - W - I \qquad (1)$$

The real plus financial cash flow tax base, is:

$$TB(r+f) = R - W - I + B - P \qquad (2)$$

which from the above identity can be seen to be equal to:

$$TB(s) = D - S + T \qquad (3)$$

TB(s) is the tax inclusive net equity distribution base. TB'(s) is the tax exclusive base, given by (D-S).

ii. Inflation Neutrality

Inflation, as noted in earlier sections, distorts the conventional measure of income because depreciation deductions, interest payments, capital gain estimates and the cost of goods sold are inaccurately measured by historic cost. This leads to the over or understatement of company profit (depending on the composition of the firm's balance sheet) and the distortion and possible dampening of investment incentives. Taken together, the effect of inflation on the tax base is to make the effective rate of tax dependent on the rate of inflation, to increase the spread of effective rates of return on different investments, and to distort the choice of debt over equity finance.

The cash flow base overcomes these problems by matching current revenues against current costs, avoiding the basic measurement problem caused by inflation[11] : a decline in the value of the measuring rod - money. Costs incurred in older more valuable dollars are not matched against recent dollars as they are in the conventional income tax base. By allowing firms, for one, to deduct the full value of investment (termed 'full expensing') when the cost is incurred, it leaves no deferred deductions to be eroded by inflation.[12] Similarly, by deducting the full cost of material when it is purchased the inventory measurement problem is avoided. Capital gain calculation is simplified to equal the full sale value since the asset cost was originally deducted. By including the proceeds of a loan in the (r+f)tax base the cash flow tax can correctly allow the firm to deduct the full nominal interest payment in subsequent years (since the present value of the nominal interest adjusted stream of payments is equal to the loan amount). The usual inflation-induced bias towards debt finance engendered by conventional income tax systems would thus disappear under the cash flow tax.

Some indexation remains essential even under cash flow tax accounting, however, with loss carryovers from one tax period to another requiring to be adjusted by the nominal rate of interest. Overdue tax

---

11/ Or, for that matter, deflation. The essential measurement problem is due to price level changes whether positive or negative.

12/ The consumption-type VAT also allows full expensing of capital goods and avoids the need to calculate or index depreciation in the measurement of value added.

liabilities must correspondingly be adjusted by the nominal interest rate to preserve the real value of tax collections.

Also, at rates of inflation approaching hyperinflation, even the cash flow base will require some additional adjustment. The essential point is that at very high rates of inflation there can be substantial increases in the price level within an accounting period such as a year. Firms which incur costs early in the year and receive payments later in the year are at a disadvantage relative to firms which, through tax planning, can reverse this ordering of events. Shortening the tax reporting period from yearly to bi-annual, or a monthly basis will reduce the severity of this problem but clearly an upper limit exists for such speeding up. Corresponding to this frequent assessment of tax liability, there is also need to shorten the tax collection lag. Some form of tax withholding may be possible or, failing that, indexation of the tax liability amount will be required.

To summarize, the neutrality advantage of the cash flow base diminishes, particularly at very high rates of inflation when adjustments such as those described above may be essential. Proponents of the cash flow tax therefore strengthen the case for such a tax by citing the additional features of the tax. Here we merely list these features without discussing them in any detail.[13]

13/ See Zodrow and McLure (1988), or Aaron and Galper (1985) for a more detailed exposition of the various attributes of the cash flow tax.

iii. Other Features: First, it is possible to integrate the company and the individual cash flow tax in such a way that the double taxation of corporate source income is avoided. It allows the elimination of the double tax on dividends so that the bias to retain earnings rather than distribute dividends is reduced. In addition, since the cash flow tax does not discriminate between capital gain and income, it removes another distortion in the decision to retain earnings.

Second, a cash flow tax that integrates the individual and the company tax also solves the difficulty of measuring accrued income by using consumption as a base. This solves the problem of achieving horizontal equity common to conventional income taxes which tax realized income.

The major argument for the cash flow tax, however, is based on grounds of efficiency, and is the well known result that, by allowing full expensing of assets, it imposes a zero effective tax rate on marginal investments i.e. those earning a normal rate of return. Inframarginal investments are taxed at the statutory rate on the above normal return or "rent" and the government earns revenue that is positive in present value terms on this part of the tax base. Since it does not introduce a wedge between before and after-tax returns, the cash flow tax is non-distorting.[14]

In spite of the many attractive features of the cash flow tax, its relative novelty, and the fact that it has not been implemented in any country, provokes skepticism. It is also true that a number of issues need to be resolved before it receives more serious consideration as a viable form of company taxation.

14/ See Zodrow and McLure (1988) for a numerical illustration of this property of the cash flow tax.

Many of the questions which need to be studied further have to do with the transition from income to cash flow taxation - what will be the effect on revenue ?, How will assets, purchased before the introduction of the cash flow tax, be treated ? What is the proposed treatment of existing debt? Some issues are administrative - in the context of a developing country, can the cash flow tax reasonably be applied to all firms or will it include only large corporations ? In countries where the VAT is in place, can two broad based consumption taxes, such as the VAT and the cash flow tax, co-exist ? More fundamentally, if it turns out that at the individual level an income tax must be retained, should a cash flow tax be applied at the business level ? If the real cash flow base is indicated, how will the financial sector be included in the tax net ? Some issues have to do with integrating the cash flow tax with international flows - how is foreign source income to be treated ? Under what circumstances regarding the structure of domestic production is a cash flow tax more warranted ? These and other questions will have to be answered before a stronger case can be made for implementing the cash flow tax.

IV. CONCLUSION

The important fact about inflation is that it affects both sides of a firm's balance sheet and any attempt to index the tax base must take into account the effect of this on accrued income. The comprehensive adjustment scheme employed in Chile and variants that are used in Brazil, Argentina, and Israel recognize this fact and begin by adjusting the balance sheet and deriving an inflation-indexed figure for taxable profit. This approach provides a conceptually correct basis for inflation adjustment of income while at the same time providing a realistic measure of net worth and an adjusted basis for taxation of real capital gain. The alternative of adjusting the income statement directly does not provide these comprehensive adjustments to net worth and may require separate adjustment to avoid taxation of nominal capital gain.

The paper also considered the inflation-neutrality feature of a tax on cash flow. This discussion yielded the conclusion that while the cash flow base would indeed substantially do away with the need for indexation, it would still require adjustment of loss carryovers and, at very high rates of inflation, require shortening of the tax reporting period. Such attenuated inflation-neutrality by itself may not be adequate to justify a changeover to a cash flow tax, especially for countries which already have comprehensive indexation in place. [15]

This paper also looked at the effects of partial indexation on the marginal effective rate of taxation (METR). Since countries with relatively low rates of inflation often allow only partial inflation adjustment a

---

15/ This paper did not discuss the various other features of the cash flow tax which may make it an attractive alternative to the income tax.

valid question is whether this is adequate. The answer that is indicated by the simulations considered here is that even rates of inflation as low as 10-20 percent can have considerable effect on the METR and its dispersion across industries, firms and assets. The extent to which a firm is leveraged, the nature of its asset structure, and the level of the statutory tax rate, interact with the particular indexation provisions to affect different firms in different ways. In general, indexing depreciation but not indexing interest expenses benefits highly leveraged firms with a high proportion of depreciable assets to a greater extent than firms with a different structure of assets and liabilities. The disparity is greater at higher tax rates and at higher rates of inflation.

The theoretical case is therefore clearly on the side of full rather than partial adjustment. But, when it comes down to implementing tax reforms, the real choices are defined by administrative constraints. Yoran (1984), noting the difficulties encountered by Israel in administering the LTDIC, observed that questions relating to whether balance sheet or income statement adjustments were appropriate, what the pace of adjustment should be, and whether unique or multiple price indices should be employed, were really second order questions. Administrative capacity, and the level of bookkeeping skills in the business sector, would define the real possibilities for inflation adjustment. The experience of Chile, as recounted by de Jantscher (1984), suggests that a comprehensive system of adjustment may only be achieved through gradual refinement of what are, at first, relatively simple, approximate, and partial corrections.

While recognizing that adjustment measures, particularly at low inflation rates, will be approximate and not comprehensive, this paper recommends that even such approximate methods should take into account the effect of inflation on both the asset and liability side of the balance sheet, and thereby, on income. For example, since capital gain from sale of assets and foreign exchange gains/losses are not typically major sources of income for companies in developing countries an approximate method may choose to exclude these items from adjustment. Instead, inflation adjustment should focus on indexing both non-monetary assets and non-monetary liabilities. This takes care of the important sources of inflationary distortions in income measurement - deductions of depreciation and nominal interest. However, it remains an incomplete correction and the attempt should be to gradually extend coverage to the other items on the income statement and balance sheet as the administrative machinery and the tax paying entities become more familiar with the practice of inflation adjustment.

APPENDIX A: Equivalence of Balance Sheet Based Adjustments

This appendix demonstrates the equivalence of the following three methods of adjusting the balance sheet and the income statement for inflation. We begin with a general proof of this equivalence and proceed to demonstrate this with two examples from the text.

The three methods being considered here are defined as follows:

1. Net Worth Method: Adjusted Gross Income = $(NW_1' - NW_0')$.
2. Net Non-Monetary Asset Adjustment:

   Adjusted Gross Income = Gross Cash Flow - Indexed Depreciation
   $+ \pi.(NMA - NML - NW)$
3. Net Monetary Liability Adjustment:

   Adjusted Gross Income = Gross Cash Flow - Indexed Depreciation
   $+ \pi.(ML - MA)$

1. General Proof of Equivalence

Recall that the balance sheet identity is written in terms of monetary and non-monetary items with net worth treated as a non-monetary item. Specifically we write assets (A) and liabilities (L) as:

$$A = MA + NMA \tag{1}$$

$$L = ML + NML + NW \tag{2}$$

Since the balance sheet identity is A = L we can write this as:

$$MA + NMA = ML + NML + NW \tag{3}$$

We begin with the expression for the net worth method which derives the adjusted gross income of the firm from :

$$\text{Adjusted Gross Income} = (NW_1' - NW_0') \tag{4}$$

Using (1 and 3), we can write the RHS of (4) as follows:

$$(NW_1' - NW_0') = (A_1' - (ML_1' + NML_1')) - (NW_0 (1+\pi))$$

which is equal to:

$$= \quad (MA_0 + \text{Pre-tax cash flow} + NMA_0\,(1+\pi)\,(1-\delta)) - (ML_0 + NML_0\,(1+\pi))$$

$$- \quad (NW_0\,(1+\pi))$$

where δ is the depreciation factor. After some re-arrangement this can be written as:

$$= \quad (\text{Pre-tax cash flow} - \delta.NMA_0\,(1+\pi)) + (MA_0 + NMA_0 - ML_0 - NML_0 - NW_0)$$

$$+ \quad \pi.\,(NMA_0 - NML_0 - NW_0) \qquad (5)$$

The expression in the second bracket must equal zero by the nature of balance sheets so that we have:

$$= \quad (\text{Pre-tax cash flow} - \delta.\,NMA_0.(1+\pi)) + \pi.(NMA_0 - NML_0 - NW_0) \qquad (6)$$

$$= \text{(Pre-tax cash flow - Indexed Depreciation)} + \pi.\,(NMA_0 - NML_0 - NW_0)$$

But the RHS is the net non-monetary asset adjustment. Thus we have shown that:

$$(NW_1' - NW_0') = (\text{Pre-tax cash flow} - \delta.NMA_0(1+\pi)) + \pi.(NMA_0 - NML_0 - NW_0) \qquad (7)$$

The LHS is the net worth adjustment which is mathematically equivalent to the net non-monetary asset adjustment on the RHS. We know from (3) that the net worth adjustment is also equivalent to the net monetary liability adjustment since:

$$ML - MA = NMA - NML - NW \qquad (3')$$

we can write (7) as:

$$(NW_1' - NW_0') = (\text{Pre-tax cash flow} - \delta.NMA_0(1+\pi)) + \pi.(ML_0 - MA_0) \qquad (8)$$

where clearly RHS is the net monetary liability adjustment.

The equivalence of the three methods of deriving comprehensive inflation-adjusted measures of income has been demonstrated.

ii. Numerical examples

In this section we reproduce the results of the net worth method in the text while using the net non-monetary asset adjustment to confirm that the two are equivalent. Specifically, we employ the inflation adjustment scheme suggested by Harberger which actually consists of the following rules:

> i) All real or indexed assets are written up by the inflation factor. This adjustment amount is written up in the income statement as a profit.
> ii) All indexed and real liabilities (including net worth items such as capital and surplus) are written up by the inflation factor and entered as a loss item in the income statement
> iii) Depreciation is calculated on the basis of the inflation-adjusted real asset value.

This set of rules is identical to the net non-monetary asset adjustment and provides the same correction to reported income as the net worth calculation described in case (b) and (c) in the text. This equivalence is demonstrated below.

Case b: The table below adjusts the balance sheet and the income statement whose initial values are the same as in case b in the text.

TABLE 6 (B): Inventory Adjustment: Balance Sheet

Balance sheet items	Initial values	Adjustment for $\pi = 0.2$	Adjusted values	Inventory depletion	Final values	
ASSETS						
Land	2000	+400	2400	- -	2400	
Inventory	100	+ 20	120	-60	60	
Cash	- -	- -	- -	- -	270	
Total	2100	+ 420	2520	-60	2730	
	Initial	Adjustment	Adjusted	Interest	Final	
LIABILITIES						
Unindexed Debt	0	0	0	- -	0	
Net worth	2100	+ 420	2520	- -	2730	
Total	2100	+ 420	2520	- -	2730	

TABLE 6 (B): Inventory Adjustment: Income Statement

Item	$\pi = 0$	Unindexed $\pi = 0.20$	Indexed $\pi = 0.20$
Sales Revenue	1000	1200	1200
- Labor cost	- 500	- 600	- 600
- Materials	- 100	- 100*	- 120**
- Inventory Depletion	- 50	- 60*	- 60**
+ Asset Adjust.	0	+ 0	+ 420
- Liab.Adjust.	0	- 0	- 420
= Adjust.Income	350	440	420
Tax Liability	175	220	210

* = FIFO accounting is used to value cost of goods.
** = This adjustment is equivalent to ILIFO.

In the table above, the valuation of goods sold in the balance sheet and income statement is carried out in the following manner: i) the beginning inventory is adjusted by the inflation factor π, as are all other real or indexed assets and liabilities, ii) the amount of inventory depletion is subtracted from the adjusted balance sheet figure, iii) the purchase of additional materials is entered in the income statement at current prices, assumed in this example to be higher than prices in the previous period by the same factor π, iv) The income statement then is adjusted by adding the total asset adjustment and subtracting total liability adjustment and inventory depletion.

Notice that both the net worth adjustment and the net non-monetary asset (π(NMA-NML-NW)) adjustment yield the same inflation adjusted measure of income i.e. 420 rather than 440 which is the unindexed measure. Since this is greater than the no-inflation situation by the same factor as the rate of inflation we know the inflation correction is accurate.

Case c: The equivalence of the two methods is confirmed again below where the income estimate of 1470 equals the income measured in text case c.

TABLE 7(B): Balance Sheet Adjustment

Balance sheet items	Initial values	Worksheet for case with π = 20 %			
		Adjustmnt	Adjvalue	Deprec.	New Value
ASSETS					
Equipment	500	+100	600	-150	450
Building	1000	+200	1200	-120	1080
Cash	- -	- -	- -		905
Receivables	- -	- -	- -		
Total	1500	+300	1800	-270	2435
Item	Initial values	Adjustmnt	Adjusted value	Interest paid	New Value
LIABILITIES					
Indexed Debt	500	+100	600	- 30	600
Unindex.Debt	500	- -	500	-130	500
Net Worth	500	+100	600		1335
Total	1500	+200	1700	-160	2435

TABLE 7(B): Income Statement Adjustment

Item	Case π = 0	Unindexed π=0.2	Indexed π= 0.2
Sales Revenue	3000	3600	3600
Labor Cost	-1000	-1200	-1200
Material Cost	- 500	- 600	- 600
Interest Payment	- 50	- 160	- 160
Depreciation	- 225	- 225	- 270
Unadjusted Income	1225	1415	1370
Asset Adjustment	- -	- -	+ 300
Liability Adjustment	- -	- -	- 200
Adjusted Income	1225	1415	1470

APPENDIX B: A Survey of Indexation Provisions in 8 Countries

Argentina: Both depreciation deductions and capital gains are adjusted for inflation through the automatic annual revaluation of assets. A General Wholesale Price Index is used in making the adjustments. Net income is adjusted by adding to it the product of the inflation rate and net monetary liabilities. For this purpose, inventory is considered a monetary rather than a real asset. No adjustment of exchange loss deductions is in place.

Bolivia: Depreciation allowances are based on historic cost, nominal interest is deductible, capital gains are estimated on the basis of historic cost and taxed as income. Not clear if inventory system approximates FIFO or LIFO. Asset revaluation occurs but is valid only for the financial report of the firm. Revenues are indexed by stating tax debts in U.S. dollars.

Brazil: Inflation adjustment applies to permanent and fixed assets, to depreciation allowances, and to net worth items. Inventory items are considered monetary assets for the purpose of this adjustment. The asset and net worth values are adjusted by the percentage change in the value of Treasury Bonds (OTNs, whose cruzado value is adjusted with inflation) and the balance sheet reflects these new values. The asset adjustment amount is added to taxable income while the net worth adjustment is deducted from profit. While revaluation of indexed or foreign currency denominated debts (debt claims) is not a specific part of the inflation adjustment, such items must be adjusted and the corresponding values must be deducted (as part of 'financial results') in calculating taxable income. Exchange losses are indexed to the change in the value of OTNs. Depreciation allowances are indexed, as noted earlier, as is capital gain which is calculated on the basis of inflation-adjusted acquisition cost. Since the decline in the

value of unindexed debt is captured as income, it is appropriate that nominal interest deductions be allowed, as they are. Inventory accounting is according to the FIFO system and there is no inflation adjustment. Taxable income is expressed in units of OTNs of the relevant tax period and is thus indexed to the OTN.

Chile: Chile, like Brazil, has a comprehensive system of inflation adjustment based on balance sheet revaluation. Both financial statements and tax accounts are subject to mandatory adjustment. The book value of fixed assets is adjusted by the change in the CPI (unless some other specific index is indicated) and depreciation deductions are on this inflation adjusted basis. Inventory values are adjusted to replacement cost and the adjustment is added to the total asset adjustment amount. The "correccion monetaria" revalues real and indexed assets and liabilities, and net worth, crediting the increase in asset values and debiting the adjustment in liability and net worth values to a special account. Foreign exchange debts and debt claims are valued at the current exchange rate. Company income is adjusted by deducting any net debit balance from taxable profit and adding a credit balance to taxable income. The interest expense deduction is on a nominal basis as is the taxation of interest income. Loss carryovers are adjusted for inflation by the change in the consumer price index. The government also protects the real value of tax revenues by adjusting the tax for inflation in the lag between the end of the commercial year and the time of payment.

Colombia: Both Depreciation deductions and inventory are not indexed but interest expense deductions are to be allowed only on the real component. The indexation of interest is a recent (1986) reform that is to be phased in over 1986-95 and also eliminates the tax on the inflation component of

interest income. LIFO is accepted by the tax authorities for inventory valuation but is restricted by requiring financial account conformity. The cost basis of assets are to be indexed and this affects both the taxation of capital gain and the presumptive income tax which equals 8 percent of the net wealth estimate. Capital gains realized after 1986 will benefit from the indexation of the cost basis as will the calculation of the patrimonio, the net wealth tax. Exchange rate losses are to be included with interest cost of debt and will be subject to the same phase-in or indexing as interest cost deductions.

Mexico: As in Brazil, the depreciation allowance adjustment is combined with an adjustment for net liabilities. Interest expenses do not have any inflation adjustments but if the decline in value of debts is taken account of in net liabilities nominal interest expense deduction is permissible.. Capital gains are taxed on a real basis while exchange losses are not indexed.

Turkey: While partial (less than 100 percent) indexing of depreciation deductions prevailed until recently, full indexing has been in place since March 1987. Inventory accounting is not inflation adjusted. The treatment of interest income/expense for tax purposes continues to be on a nominal basis. No information is available on the tax treatment of capital gains.

Israel: Israel, under the Law of Taxation during inflation (LTDIC) used an adjustment to income akin to the Brazilian scheme i.e. π.(Protected assets - protected liabilities and net worth). Like Brazil, Israel did not consider inventory in the asset revaluation. It also did not consider machinery and equipment as protected assets but tried to offset this by not adjusting the depreciation deduction on such assets. In 1985 the law was amended to include equipment and machinery under protected assets.

BIBLIOGRAPHY

1. Aaron, Henry J. (ed),- Inflation and the Income Tax - Brookings Institute, 1976.

2. Aaron, Henry J. and Harvey Galper,- Assessing Tax Reform - Brookings Institution, 1985.

3. Aaron, Henry J. and Harvey Galper,- The Cash-Flow Income Tax - Non-Political Thinking about Tax Reform, in National Tax Association- Tax Institute of America, Proceedings of 78th Annual Conference, Denver, Colorado, 1985

4. Bernard and Hayn,- Inflation and the Distribution of the Corporate Income Tax Burden, National Tax Journal, 39:171-87, Jume 1986.

5. Bradford, David F.,- Untangling the Income Tax - Harvard University Press, 1986.

6. Bulow, Jeremy and John B. Shoven,- Inflation, Corporate Profits and the Rate of Return to Capital- in Inflation - Causes and Effects - edited by Robert E. Hall, NBER, 1982.

7. Bulow, Jeremy and John B. Shoven,- Inflation Accounting and Nonfinancial Corporate Profits - Part I and II, Brookings Papers on Economic Activity, 3: 1975, 1: 1976.

8. Feldstein, Martin,- Inflation, Tax Rules, and Capital Formation -National Bureau of Economic Research, 1983

9. Fullerton, Don,- The Indexation of Interest, Depreciation, and Capital Gains and Tax reform in the United States - Journal of Public Economics, February 1987

10. Gil Diaz, Francisco,- Some Lessons from Mexico's Tax Reform- in Newbery and Stern, (ed.) - The Theory of Taxation for Developing Countries- Oxford University Press, 1987

11. Hall, Robert E.,- Tax Treatment of Depreciation, Capital Gains, and Interest in an Inflationary Economy- in Charles R. Hulten (ed.) - Depreciation, Inflation, and the Taxation of Income from Capital - Urban Institute Press, 1981

12. Halperin, Daniel and Eugene Steuerle,- Indexing the Tax System for Inflation, in Aaron, Galper, and Pechman (ed.),-Uneasy Compromise: Problems of a Hybrid Income-Consumption Tax, Brookings Institution, 1988.

13. Harberger, Arnold C.,- Notes on the Indexation of Income taxes- mimeo, 1982. Also in Aaron, Galper, and Pechman (ed.),-Uneasy Compromise: Problems of a Hybrid Income-Consumption Tax, Brookings Institution, 1988.

14. Kay J.A. and Mervyn King,- The British Tax System - Oxford University Press, Fourth Edition

15. Kay, J. A.,- Inflation Accounting: A Review Article- Economic Journal 87, 1977, 300-311

16. King, Mervyn and Don Fullerton,- The Taxation of Income from Capital: A Comparative Study of the United States, the United Kingdom, Sweden, and West Germany - National Bureau of Economic Research, 1984

17. Lapidoth, Arye,- The Israeli Experience of an Inflation Adjusted Tax Base: With Special Reference to Income Tax Law, (Adjustment for Inflation) Provisional Measure, 5755-1985, International Bureau of Fiscal Documentation, March 1986.

18. Liesner T. and Mervyn King,- Indexing for Inflation - London: Hienemann Educational Books, 1975

19. Pellechio, Anthony J.,- A Model for Analysis of Taxation of Capital Investment in Developing Countries - Development Research Department, Discussion Paper # DRD263, The World Bank, 1986.

20. Tanzi, Vito,- Inflation and the Personal Income Tax: An International Perspective - Cambridge University Press, 1980.

21. Tybout, James,- The Algebra of Inflation Accounting, World Bank, DRD Discussion Paper, July 1984.

22. Yoran, Aharon, and Milka Casanegra de Jantscher, et. al. in - Adjustments for Tax Purposes in Highly Inflationary Economies- Proceedings of a Seminar of the International Fiscal Association, Buenos Aires, 1984.

23. Zodrow, George R. and Charles E. McLure Jr.,- Implementing Direct Consumption Taxes in Developing Countries, PPR Working Paper, The World Bank, January, 1988.

PPR Working Paper Series

	Title	Author	Date	Contact for paper
WPS265	The Influence of Imperfect Competition in International Markets: Some Empirical Evidence	Alexander Yeats		
WPS266	Policy Changes that Encourage Private Business Investment in Colombia	Mansoor Dailami	August 1989	M. Raggambi 61696
WPS267	Issues in Income Tax Reform in Developing Countries	Cheryl W. Gray		
WPS268	Shortcomings in the Market for Developing Country Debt	John Wakeman-Linn	September 1989	S. King-Watson 33730
WPS269	Women in Development: Issues for Economic and Sector Analysis	Women in Development Division	August 1989	J. Lai 33753
WPS270	Fuelwood Stumpage: Financing Renewable Energy for the World's Other Half	Keith Openshaw Charles Feinstein	September 1989	J. Mullan 33250
WPS271	The Industrial Labor Market and Economic Performance in Senegal: A Study of Enterprise Ownership, Export Orientation, and Government Regulation	Katherine Terrell Jan Svejnar		
WPS272	Women's Changing Participation in the Labor Force: A World Perspective	T. Paul Schultz		
WPS273	FY88 Annual Sector Review: Population, Health and Nutrition	Population and Human Resources Department		
WPS274	The Demography of Zaire: Review of Trends in Mortality and Fertility	Miriam Schneidman		
WPS275	Revised Estimates and Projections of International Migration, 1980-2000	Fred Arnold	August 1989	S. Ainsworth 31091
WPS276	Improving Rural Wages in India	Shahidur R. Khandker	August 1989	B. Smith 35108
WPS277	The Effect of Formal Credit on Output and Employment in Rural India	Shahidur R. Khandker Hans P. Binswanger	August 1989	B. Smith 35108
WPS278	Inflation and the Company Tax Base Methods to Minimize Inflation-Induced Distortions	Anand Rajaram	September 1989	A. Bhalla 60359

PPR Working Paper Series

	Title	Author	Date	Contact for paper
WPS279	What Determines the Rate of Growth and Technological Change	Paul M. Romer		
WPS280	Adjustment Policies in East Asia	Bela Balassa	September 1989	N. Campbell 33769
WPS281	Tariff Policy and Taxation in Developing Countries	Bela Balassa	September 1989	N. Campbell 33769
WPS282	EMENA Manufactured Exports and EEC Trade Policy	Bela Balassa		
WPS283	Experiences of Financial Distress in Thailand	Tipsuda Sundaravej Prasarn Trairatvorakul		
WPS284	The Role of Groups and Credit Cooperatives in Rural Lending	Gershon Feder Monika Huppi		
WPS285	A Multimarket Model for Turkish Agriculture	Jeffrey S. Hammer Alexandra G. Tan		